

MIHPT-01

MIHPT-04

1555

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Introduction

Cascade Technical Services has prepared this Data Imaging Report for REI based on data produced by the advancement of the MiHPT system at the Tower Standard. This report provides visual renderings of data using the Mining Visualization System (MVS) software; develop by CTech Development Corporation (www.ctech.com).

Renderings of MIP, EC and HPT data are provided in the four dimensional models (model files are provided individually as separate attachments). These models are composed of the three spatial dimensions with the additional dimension relating to detector response (commonly referred to as 4DIM models). The models provide an interactive interface that allows the user to produce screen shots from any angle, magnification, or detector response value for each respective model.

The sections below provide a summary of the project, a summary of the data imaging contained in this report, a description of the how the images provided were developed, a description how to navigate 4DIM models, 4DIM files (separate files), and a description of the limitations regarding the imaging presented with this report.

Project Summary

This section provides a summary of field activities completed by Cascade Technical Services at the Tower Standard, the equipment used, the duration of field activities, the configuration of the MiHPT system and any relevant site information provided by REI.

On July 11th through 14th 2015, Cascade Technical Services advanced 17 direct push MiHPT borings from the ground surface to between 20 to 63 feet below ground surface (bgs). In order to advance the MiHPT borings Cascade Technical Services mobilized one MiHPT system, one MiHPT specialist and one direct-push drill rig operator to the project site.

For the purposes of this project, the MiHPT system was equipped with an Electrical Conductivity probe, an Electron Capture Detector (ECD), a Photo Ionization Detector (PID), a Flame Ionization Detector (FID) and a Halogenated Specific Detector (XSD). During the advancement of each boring, the response of each detector, relative to depth, was recorded in accordance with the standard operating procedures for the MiHPT system.

The details associated with each boring are presented in Table 1 below.

Table 1 Summary of MiHPT Borings

MiHPT Boring	Date	Time	Total Depth	Dissipation test Depth	Notes
MiHPT-01	07/11/2016	10:07	52.50	16.73 22.83 35.78 48.78(failed) 52.23	Refusal at 52.50 feet bgs.
MiHPT-02	07/11/2016	13:06	39.00	18.23 24.28(failed) 30.18(failed) 33.23(failed) 36.28 38.73	Refusal at 39.00 feet bgs.
MiHPT-03	7/11/2016	15:15	49.30	19.88 28.83 36.83 44.83	Refusal at 49.30 feet bgs.
MiHPT-04	07/12/2016	07:47	59.25	19.33 29.23 37.28 46.38 58.98	Refusal at 59.25 feet bgs.
MiHPT-05	07/12/2016	10:35	62.15	24.93 29.93 37.28 46.33 58.98	None.
MiHPT-06	07/12/2016	13:58	52.35	19.83 36.83(failed) 46.88	None.
MiHPT-07	07/13/2016	08:41	63.35	21.13 27.08 39.23 48.23 63.08	Refusal at 63.35 feet bgs.
MiHPT-08	07/13/2016	11:27	37.25	21.03 31.03 36.98	None.

MiHPT-09	07/13/2016	14:01	27.30	20.23 23.23 27.03	None.
MiHPT-10	07/13/2016	15:31	19:40	19.13	None.
MiHPT-11	07/13/2016	16:39	53.15	20.18 33.23 40.18	None.
MiHPT-12	07/14/2016	07:51	22.15	20.98	None.
MiHPT-13	07/14/2016	09:56	41.75	22.88 32.88 37.88 41.88	Refusal at 41.75 feet bgs.
MiHPT-14	07/14/2016	11:08	59.60	20.18 31.13 39.18 51.13 59.33	Refusal at 59.50 feet bgs.
MiHPT-15	07/14/2016	14:27	34.25	22.93 33.93	None.
MiHPT-16	07/14/2016	16:06	20.50	20.23	None.
MiHPT-17	07/14/2016	17:38	22.30	22.03	None.

Summary of Data Visualization

Data Visualization is graphical display of MiHPT information, which provides an interpolation of their data set. This output, which is provided in 4DIM files, provides the user a powerful tool of a skilled visualization options. This option gives a visual interpolation of the detector or analytical results. This allows the end user to see how the data come together and to visualize potential movement of the contaminant. At the same time it provides a way for the environmental firm to display potential remediation approaches to the end user in simplistic format.

Model Development

This section describes the types of images provided in this report and the methods used to develop them. As noted above, Cascade Technical Services utilized CTech's MVS software to develop the data renderings that are listed in this report. The settings and parameters associated with these renderings are based on the suggested configuration by CTech. Cascade Technical Services used MVS software to develop a base model and three types of data imaging including:

- ☐ Three dimensional models;
- ☐ Vertical cross-sections; and
- ☐ Horizontal cross-sections.

Each of these model types may be produced using the various data types. For example, three dimensional models may be produced using MiHPT response, as well as using EC to give a three dimensional indication of site lithology. Below is a discussion regarding the settings and parameters associated with each type of data images previously noted.

Prior to Kriging MiHPT data, a domain is created as a hierarchy to the MiHPT data, which is comprised of all the sample locations. This is called the convex hull which can be visualized as the shape assumed by a rubber band that has been stretched around the set and released to conform as closely as possible to it. MiHPT data is then Kriged, which is a mathematical process recognized by the EPA as the standard means for interpolation and extrapolation of measured data.

4DIM Models Provided

Cascade Technical Services has provided 4DIM models which allow the user to manipulate each model spatially and determine the detector response value. The user of these models may select various angles, magnifications, and detector response values to develop their own static figures of these models. The following 4DIM models are listed in this report in Table 2 (please note that these are standalone files and only viewable on a computer).

Three Dimensional Models

Three Dimensional Models represent a collection of points in 3D space. The models will display the interpolation of the data used within this project at various concentrations and/or responses. They give the viewer an indication of the extent of distribution based on the data set used. However the interpolation has limitations based on the gridding pattern and depth of the borings. To provide a complete interpolation, the borings X and Y need to be within a grid pattern.

Vertical Cross-Sections

Vertical Cross-Sections are comprised of connecting borings and providing a vertical profile of the model providing all detector information from surface to total depth. These are viewed from easting or northing of the model and provide side profile of the detector responses.

Horizontal Cross-Sections

Horizontal Cross-Sections are horizontal profiles of the base model at a given depth providing all detector information at a given depth in Mean Sea Level (MSL). These are viewed from a plan view and provide the detector response at each depth.

Histogram

Histogram is a geographical representation of the distribution of numerical data. It is an estimate of the probability distribution of a continuous variable.

Model Development Notes

Site boring coordinates were surveyed by REI in WTM (Wisconsin Transverse Mercator).

Access to 4DIM Models

4DIM Link: <https://od.lk/d/MF8xMjQyNDMzMTdf/4dim%20-%20rei%20-%20tower%20standard%20-%20lac%20du%20flambeau%2C%20wi%20-%208-5-2016.zip>

To view 4DIM files, the user is required to have the 4DIM Player installed on his/her computer. The 4DIM Player may be downloaded at <http://www.ctech.com/?page=&action=download&fid=129> or accessed via the CTech website www.ctech.com.

Table 2 List of 4DIM files provided to REI

Name of file	Date issued
EC - 3D - REI - TOWER STANDARD - LAC DU FLAMBEAU, WI - 8-5-2016.4D	8/8/2016
EC - EASTING SLICE - REI - TOWER STANDARD - LAC DU FLAMBEAU, WI - 8-5-2016.4D	8/8/2016
EC - HORIZONTAL SLICE - REI - TOWER STANDARD - LAC DU FLAMBEAU, WI - 8-5-2016.4D	8/8/2016
EC - NORTHING SLICE - REI - TOWER STANDARD - LAC DU FLAMBEAU, WI - 8-5-2016.4D	8/8/2016
EST. K - 3D - REI - TOWER STANDARD - LAC DU FLAMBEAU, WI - 8-5-2016.4D	8/8/2016
EST. K - EASTING SLICE - REI - TOWER STANDARD - LAC DU FLAMBEAU, WI - 8-5-2016.4D	8/8/2016
EST. K - NORTHING SLICE - REI - TOWER STANDARD - LAC DU FLAMBEAU, WI - 8-5-2016.4D	8/8/2016
EST.K - HORIZONTAL SLICE - REI - TOWER STANDARD - LAC DU FLAMBEAU, WI - 8-5-2016.4D	8/8/2016
FID - 3D - REI - TOWER STANDARD - LAC DU FLAMBEAU, WI - 8-5-2016.4D	8/8/2016
FID - EASTING SLICE - REI - TOWER STANDARD - LAC DU FLAMBEAU, WI - 8-5-2016.4D	8/8/2016
FID - HORIZONTAL SLICE - REI - TOWER STANDARD - LAC DU FLAMBEAU, WI - 8-5-2016.4D	8/8/2016
FID - NORTHING SLICE - REI - TOWER STANDARD - LAC DU FLAMBEAU, WI - 8-5-2016.4D	8/8/2016
HPT FLOW - 3D - REI - TOWER STANDARD - LAC DU FLAMBEAU, WI - 8-5-2016.4D	8/8/2016
HPT FLOW - EASTING SLICE - REI - TOWER STANDARD - LAC DU FLAMBEAU, WI - 8-5-2016.4D	8/8/2016
HPT FLOW - HORIZONTAL SLICE - REI - TOWER STANDARD - LAC DU FLAMBEAU, WI - 8-5-2016.4D	8/8/2016
HPT FLOW - NORTHING SLICE - REI - TOWER STANDARD - LAC DU FLAMBEAU, WI - 8-5-2016.4D	8/8/2016
HPT PRESSURE - 3D - REI - TOWER STANDARD - LAC DU FLAMBEAU, WI - 8-5-2016.4D	8/8/2016
HPT PRESSURE - EASTING SLICE - REI - TOWER STANDARD - LAC DU FLAMBEAU, WI - 8-5-2016.4D	8/8/2016
HPT PRESSURE - HORIZONTAL SLICE - REI - TOWER STANDARD - LAC DU FLAMBEAU, WI - 8-5-2016.4D	8/8/2016

HPT PRESSURE - NORTHING SLICE - REI - TOWER STANDARD - LAC DU FLAMBEAU, WI - 8-5-2016.4D	8/8/2016
PID - 3D - REI - TOWER STANDARD - LAC DU FLAMBEAU, WI - 8-5-2016.4D	8/8/2016
PID - EASTING SLICE - REI - TOWER STANDARD - LAC DU FLAMBEAU, WI - 8-5-2016.4D	8/8/2016
PID - HORIZONTAL SLICE - REI - TOWER STANDARD - LAC DU FLAMBEAU, WI - 8-5-2016.4D	8/8/2016
PID - NORTHING SLICE - REI - TOWER STANDARD - LAC DU FLAMBEAU, WI - 8-5-2016.4D	8/8/2016
XSD - 3D - REI - TOWER STANDARD - LAC DU FLAMBEAU, WI - 8-5-2016.4D	8/8/2016
XSD - EASTING SLICE - REI - TOWER STANDARD - LAC DU FLAMBEAU, WI - 8-5-2016.4D	8/8/2016
XSD - HORIZONTAL SLICE - REI - TOWER STANDARD - LAC DU FLAMBEAU, WI - 8-5-2016.4D	8/8/2016
XSD - NORTHING SLICE - REI - TOWER STANDARD - LAC DU FLAMBEAU, WI - 8-5-2016.4D	8/8/2016

Limitations

The information and images presented in this report rely on data produced by Cascade Technical Services under the supervision of REI and/or data provided by REI. Because Cascade Technical Services report is based on information, the accuracy of which has not been determined, Cascade Technical Services cannot and does not guarantee that the information and images provided in this report are exact representations of potential conditions at the Site. The graphics provided within this report have been prepared using CTech's industry accepted Mining Visualization System software. Unless requested by REI, the models presented herein were developed using the recommended settings and values provided by CTech. Unless stated otherwise herein, this report is intended for the sole use of REI. Cascade Technical Services assumes no responsibility for decisions or actions based on the information and images contained in this report.

Histogram: What is it and why we use it.

The histogram is a fundamental object for summarizing the frequency distribution of an attribute or combination of attributes. A histogram summarizes a dataset by grouping the data values into subsets, or “buckets” and then, for each bucket, computing a small set of summary statistics that can be used to approximately reconstruct the data in the bucket. Histograms are commonly used in statistics to demonstrate how many of a certain type of variable occurs within a specific range.

A histogram is a graphical method of presenting a large amount of data by way of bars, to reflect the distribution frequency and proportion or density of each class interval as a data set. Since a histogram provides planners and analysts with information presented in a compact and organized manner, it allows one to perform the following:

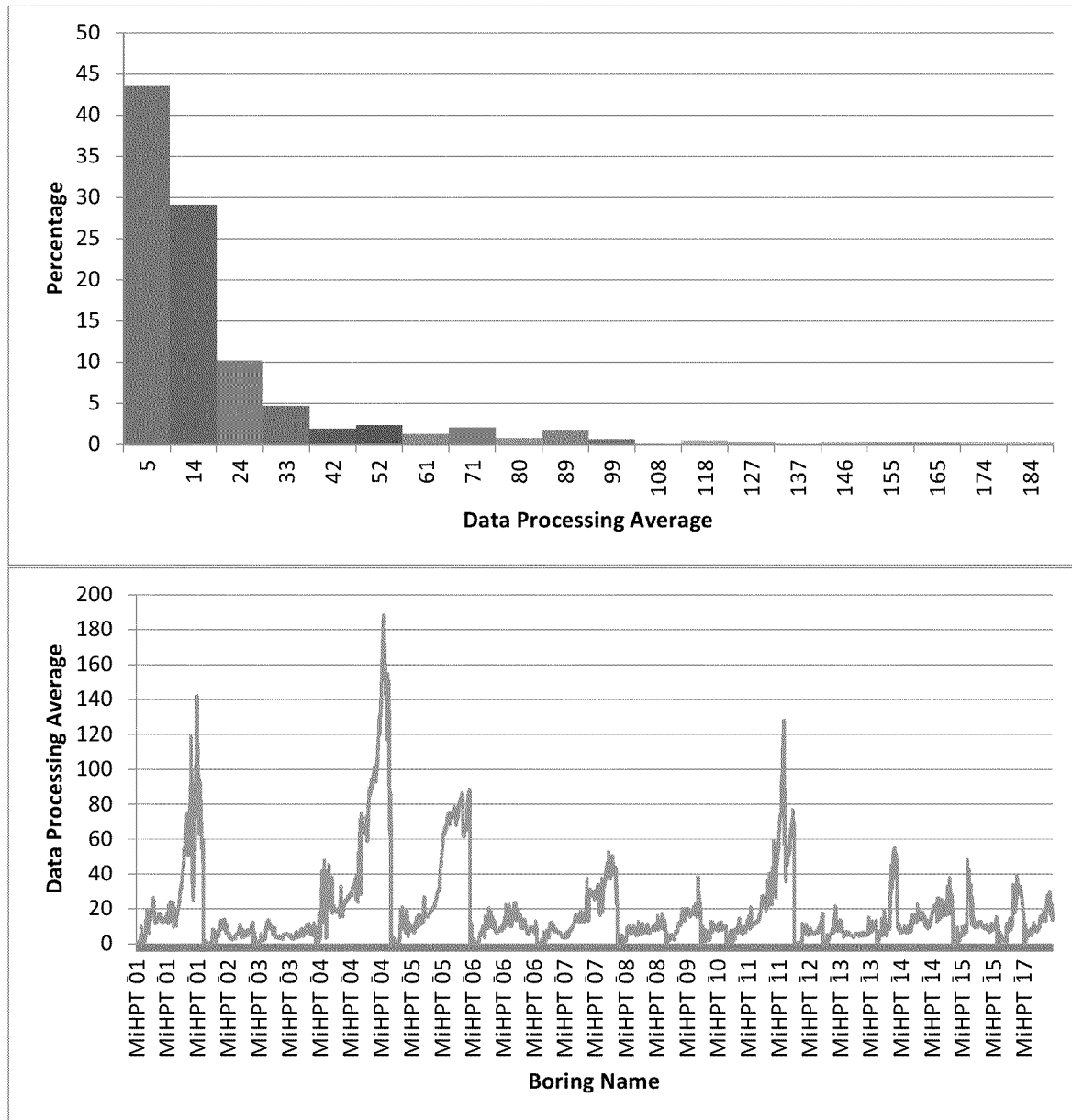
- *Analyze a large data set without having to delve in to word descriptions for purposes of distinguishing each variable and their frequencies in a given set of intervals.
- *Facilitate the comparison of process results with specification limits.
- *Instantly communicate information about variables; their values and their occurrences quickly and easily to other.
- *Make informed decisions based on data analysis.

Line graph: What is it and why we use it

A line graph is a device that displays quantitative information or illustrates relationships between two changing quantities (variables) with a line or curve that connects a series of successive data points.

The graph depicts a site wide statistical average of all the borings based on the overall responses of each analyte. It allows you a better understanding of where the highest and lowest concentrations occur. The Histogram breaks down the data into statistical averages whereas the line graph shows the same data based on boring location.

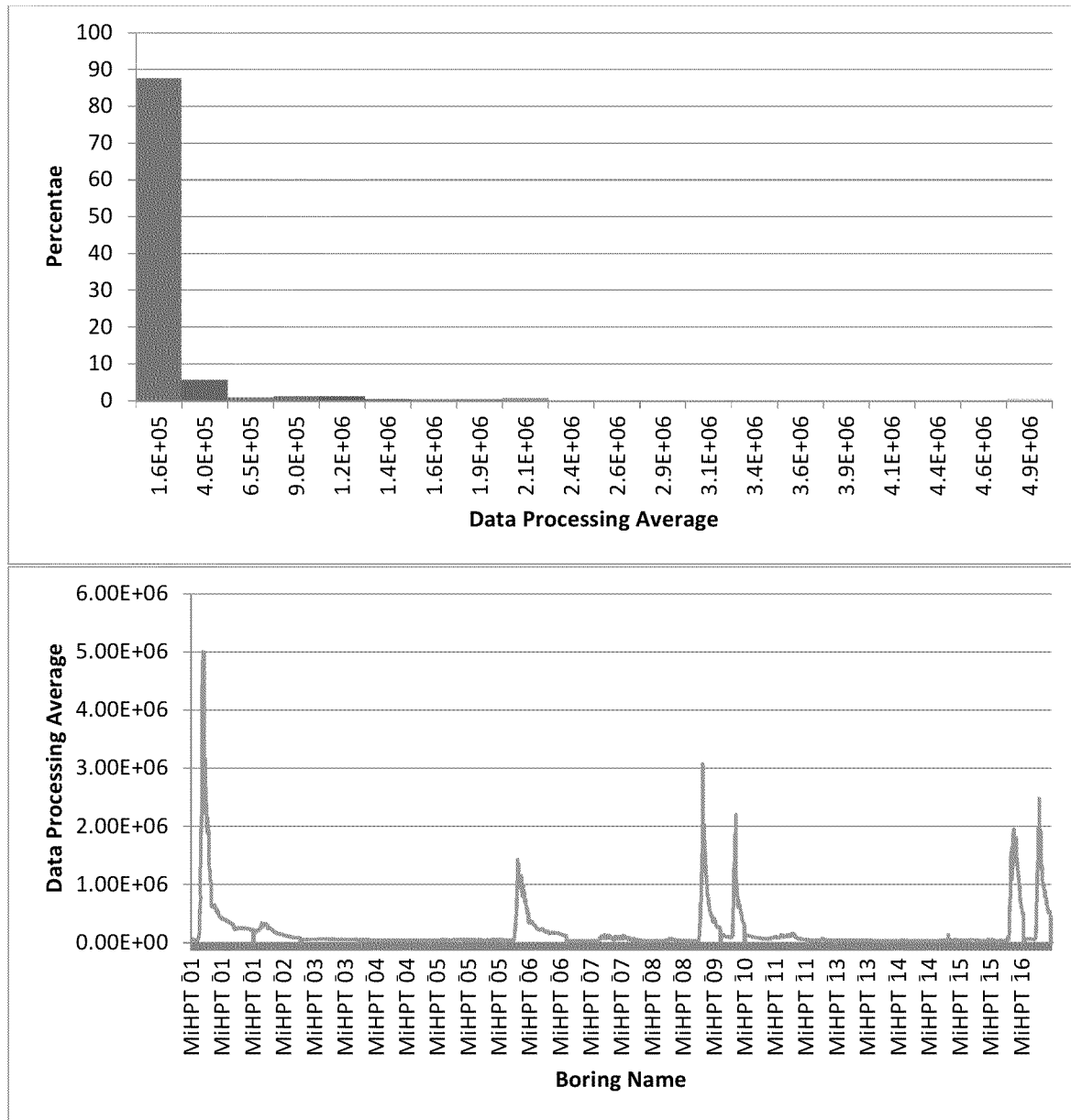
ELECTRICAL CONDUCTIVITY Histogram



Data Processing Minimum Value: 0

Data Processing Maximum Value: 188.31

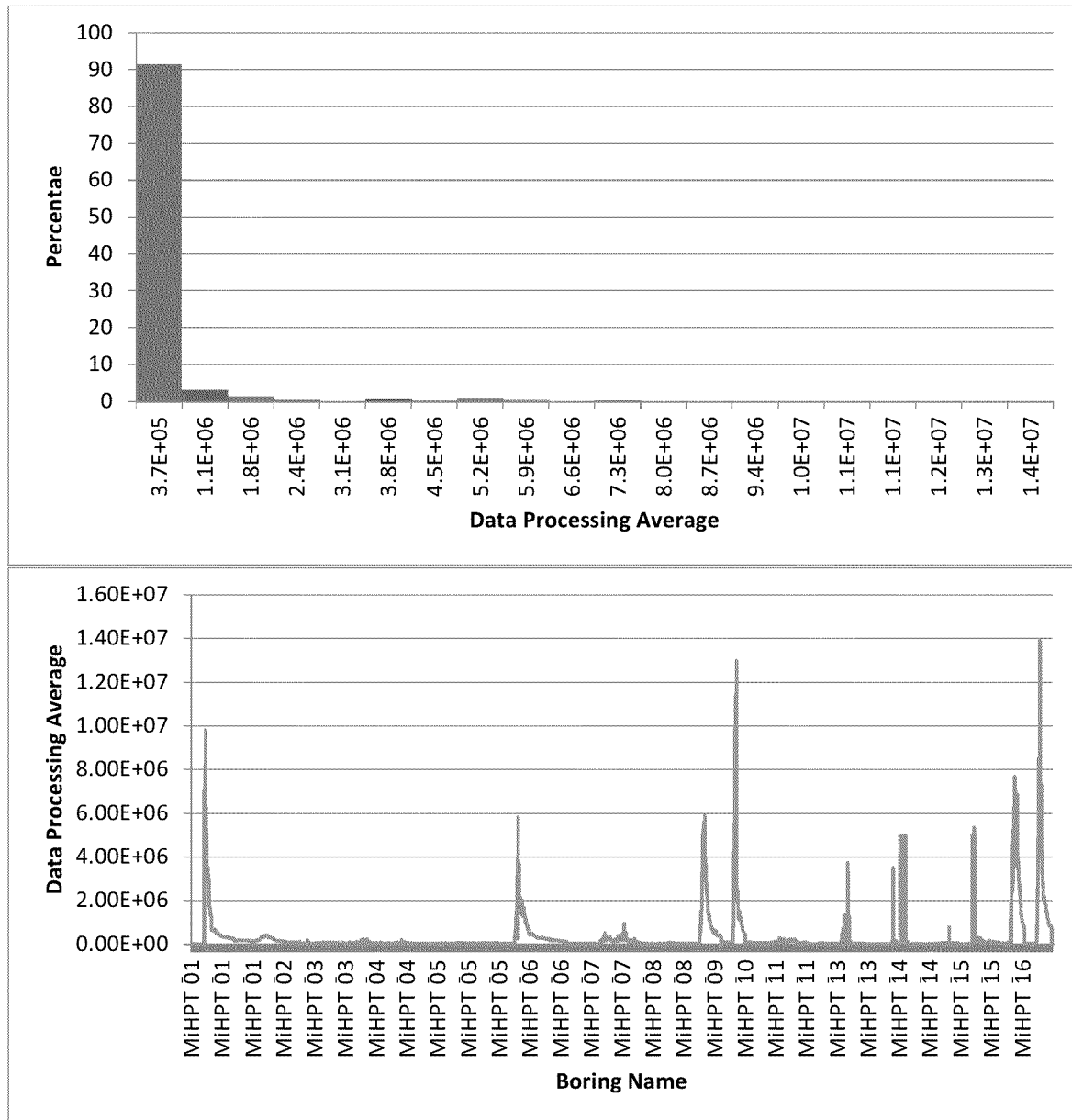
PID Histogram



Data Processing Minimum Value: 32350

Data Processing Maximum Value: 5000000

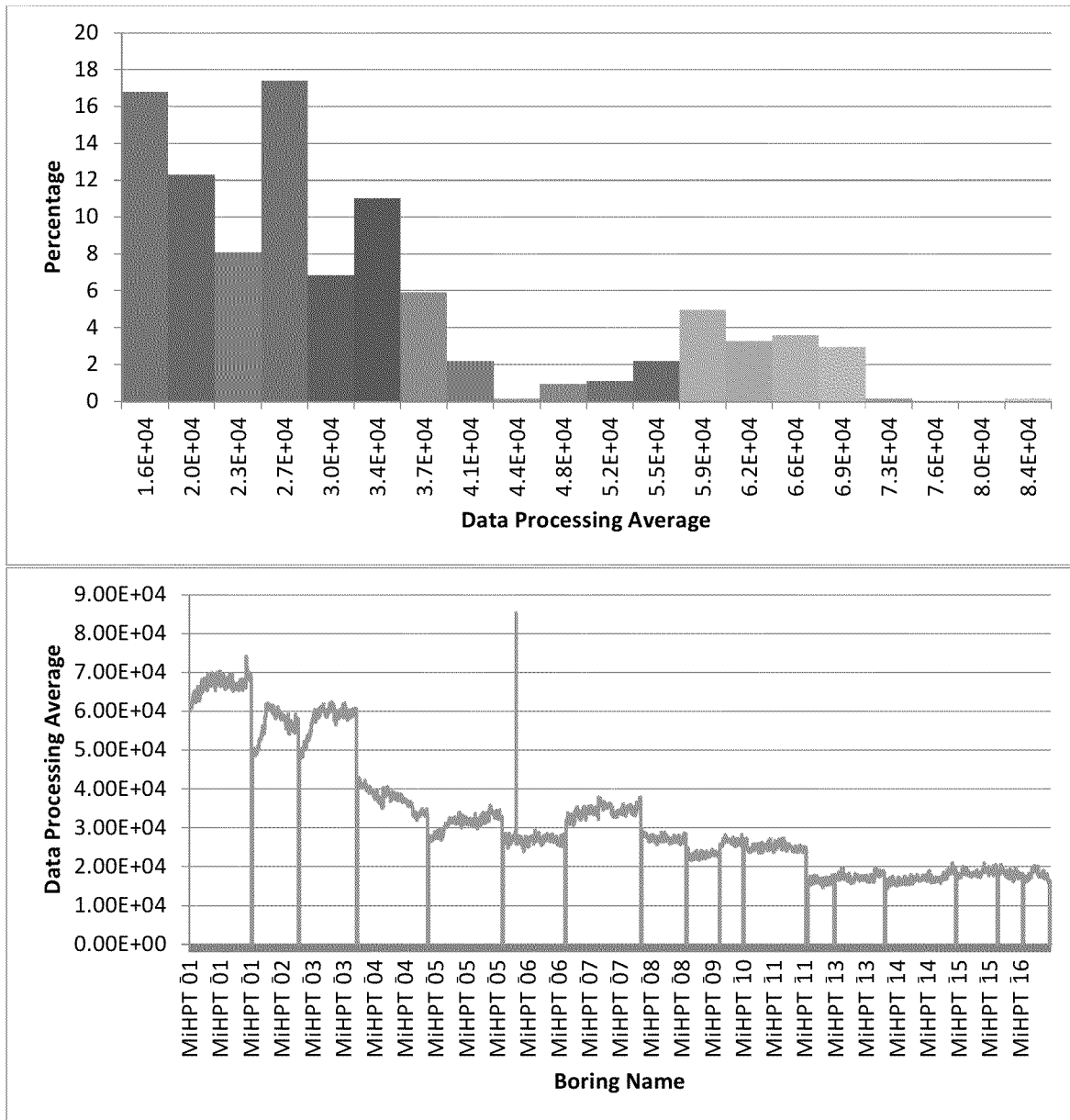
FID Histogram



Data Processing Minimum Value: 18006

Data Processing Maximum Value: 13898129

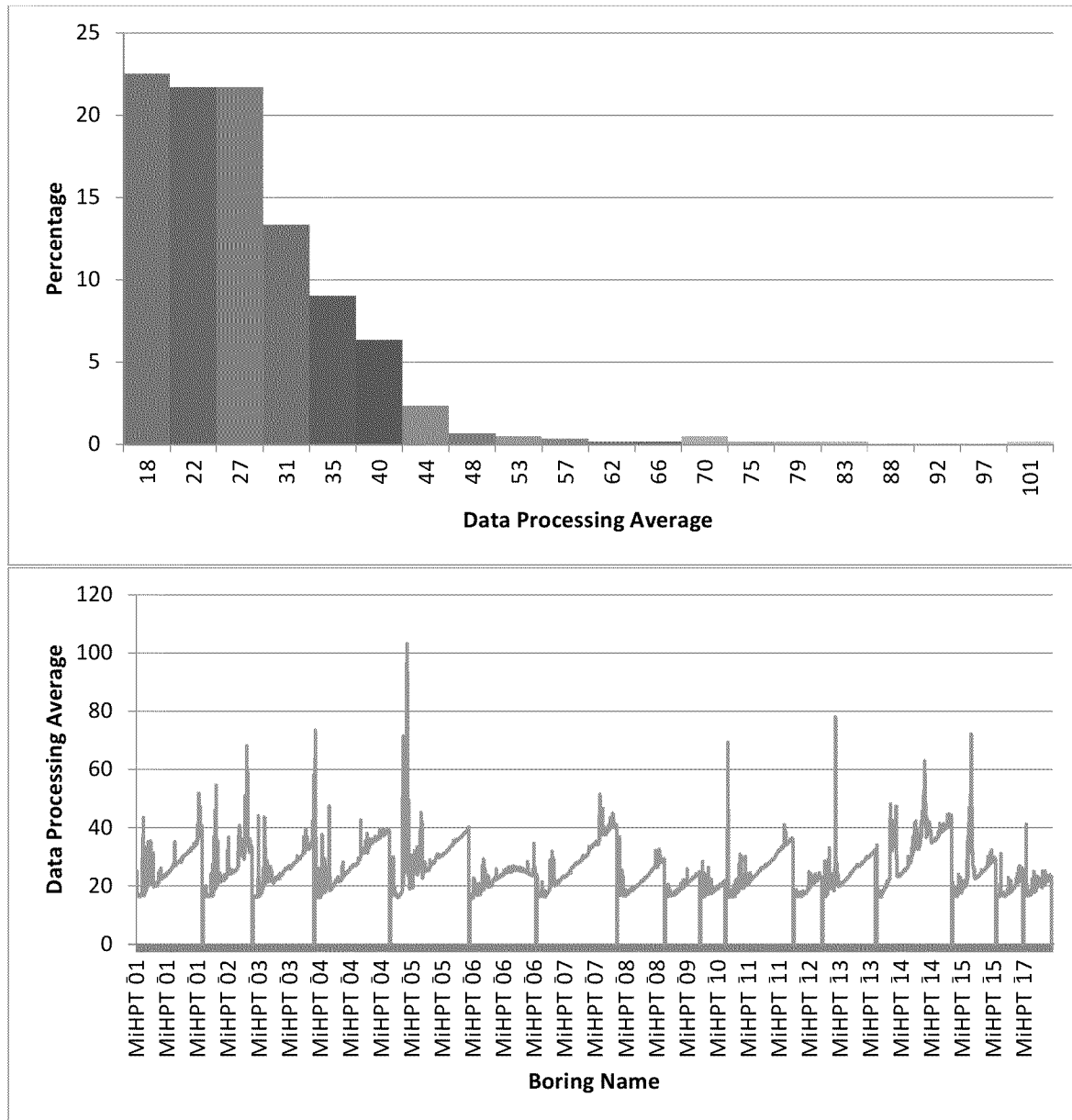
XSD Histogram



Data Processing Minimum Value: 14191

Data Processing Maximum Value: 85299

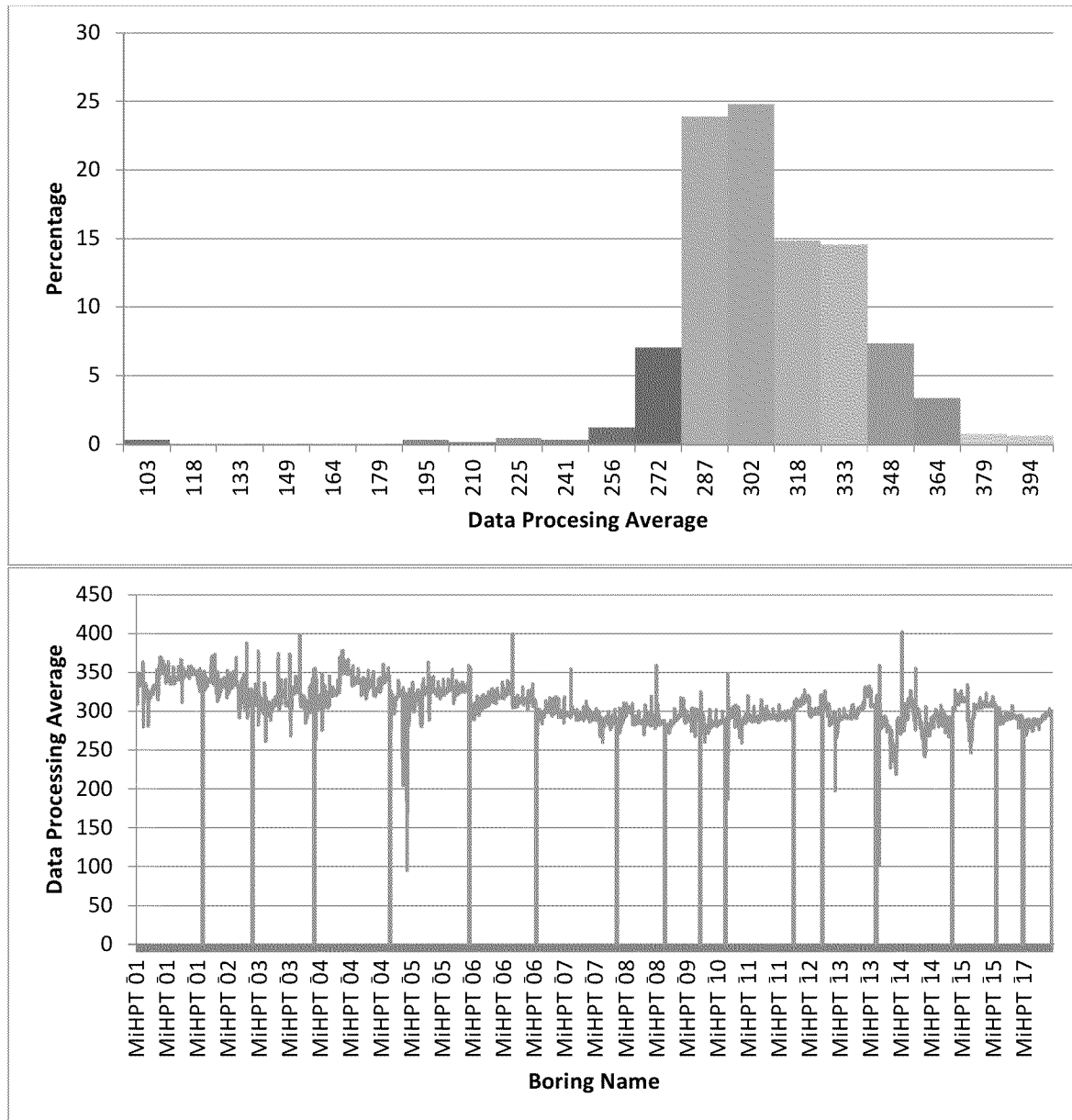
HPT PRESSURE Histogram



Data Processing Minimum Value: 15.555

Data Processing Maximum Value: 103.206

HPT FLOW Histogram



Data Processing Minimum Value: 95

Data Processing Maximum Value: 402